Impact of the crystallisation pathway of inulin on its mono-hydrate to hemi-hydrate thermal transition

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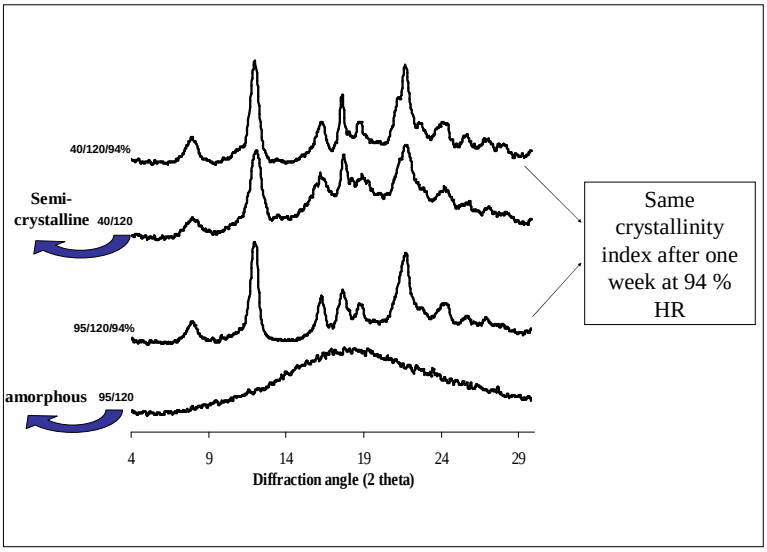
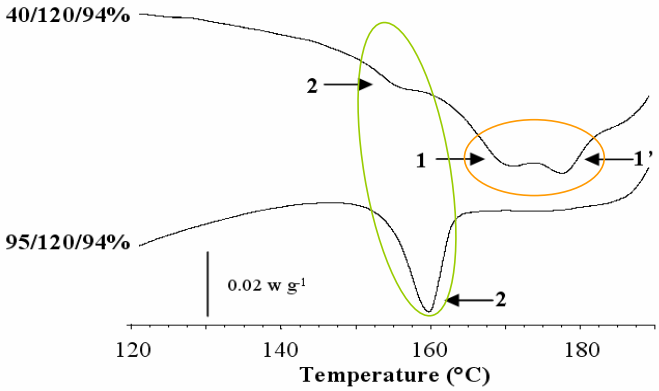
Introduction

Inulin plays a major role in the food industry as dietary fibre, bulking agent and fat or sugar substitute. Thermal properties of two inulins obtained from different crystallisation pathways were investigated. The first one, was obtained by fractional precipitation of a saturated inulin solution (40/120). The second one, came from a solid amorphous inulin (95/120). These two inulins were spray dried with an inlet air temperature of 120°C. Then, these powders were placed into controlled atmosphere conditions at 0 % HR during one week and at 94% during the same time. Finally the two inulins were called 40/120/94% and 95/120/94% and their thermal properties were investigated by Wide angle X-ray scattering (WAXS), differential scanning calorimetry (DSC), temperature resolved wide angle X-ray scattering (TRWAXS) and thermogravimetry (TGA).

WAXS



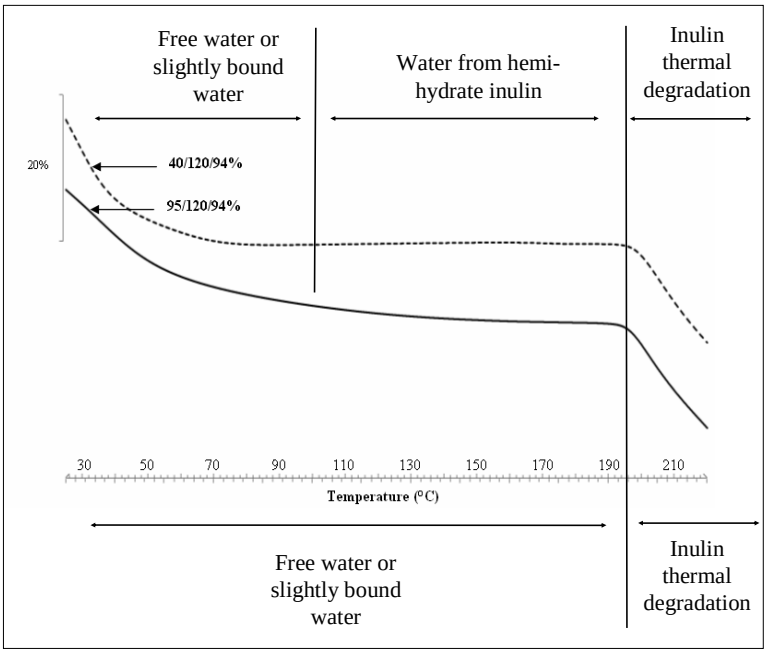
DSC



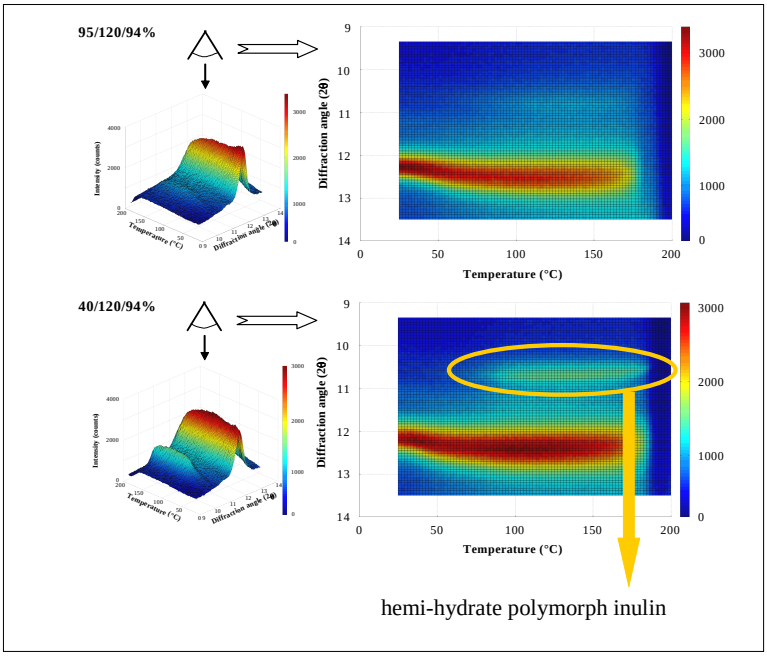
(2) → melting of crystals formed durinfg the one week storage at 94% HR

(1) and (1') → double crystal polulation

TGA



TRWAXS



Conclusion

Although WAXS did not show any difference between the two inulin, thermal analysis revealed the existence of a hemi-hydratate inulin (40/120/94%). This fact has an implication on the processing of the powder at an industrial level. Indeed, 40/120/94% has shown an agglomeration whereas 95/120/94% was a continuous mass. In other words, polymorphism of inulin crystals induces technofunctionality changes of the powder (hygroscopy, solubility, etc.) which could have an impact during processing or formulation of the powder.